

CLAIMS

1. A method for cleaning a wafer and the like and removing particles therefrom, comprising the steps of:
 - a) applying a film of sacrificial material to the wafer, and
 - b) exposing said film to light from a laser to remove said sacrificial material and said particles.
2. A method as in claim 1, wherein said step of applying said film of sacrificial material comprises applying said film to an effective thickness for removal of said particles.
3. A method as in claim 1, said particles having a size distribution ranging from a smallest diameter to a largest diameter, wherein said step of applying said film of sacrificial material comprises applying said film to a thickness between one-tenth of said smallest diameter and twice said largest diameter.
4. A method as in claim 1, wherein said step of applying said film of sacrificial material is performed by spraying a solution onto said wafer.
5. A method as in claim 1, wherein said step of applying said film of sacrificial material is performed by spinning a solution onto said wafer.
6. A method as in claim 1, further comprising the step of drying said film of sacrificial material before performing said exposing step.
7. 8. A method as in claim 1, wherein said step of applying said film of sacrificial material comprises applying a quantity of nitrocellulose.
8. 9. A method as in claim 1, wherein said step of applying said film of sacrificial material comprises applying a solution of soluble nitrocellulose in a mixture of alcohol and ether.
- a 10. A method as in claim 1, wherein said step of applying said film of sacrificial material comprises applying a quantity of pyroxylin.
- 10 11. A method as in claim 1, wherein said step of applying said film of sacrificial material comprises applying a quantity of collodion.

- 11 12. A method as in claim 1, wherein said exposing step is performed by exposing said film to light from an excimer laser having an effective wavelength for removing said sacrificial film.
- 12 13. A method as in claim ¹¹12 wherein said sacrificial film is collodion and said effective wavelength is between about 150 and about 400 nanometers.
- 13 14. A method as in claim ¹¹12 wherein said light from said excimer laser irradiates said wafer at less than about 100 millijoules per square centimeter.
- 14 15. A method as in claim 1, further comprising the step of providing a flow of vapor across said wafer while performing said exposing step.
- 15 16. A method as in claim ¹⁴15, wherein said flow of vapor is laminar flow.
- 16 17. A method as in claim 1, further comprising the step of providing a flow of an inert gas across said wafer while performing said exposing step.
- 17 18. A method as in claim ¹⁶17, wherein said inert gas is selected from the list consisting of nitrogen and argon.
- 18 19. A method as in claim ¹⁶17, wherein said flow of an inert gas is laminar flow.
- 19 20. A method for cleaning a wafer and the like and removing particles therefrom, comprising the steps of:
- 20 a) applying a film of sacrificial material to the wafer, said sacrificial film comprising collodion,
- 21 b) exposing said film to light from a laser emitting light having an effective wavelength, and
- 22 c) providing a flow of an inert gas across said wafer while performing said exposing step (b) to remove said sacrificial material and said particles.
- 23 21. A method as in claim 20, wherein said sacrificial film is applied as a solution of collodion in a solvent, said method further comprising the step of:
- 24 d) removing said solvent from said sacrificial film to form a dry collodion film.
- 25 22. A method as in claim 20 wherein said effective wavelength of said light is between about 150 and about 400 nanometers.

22 23. A method as in claim 20 wherein said light from said laser irradiates said wafer at less than about 100 millijoules per square centimeter.

23 24. An improved semiconductor wafer processing apparatus for cleaning a wafer surface and the like and removing particles therefrom, said apparatus comprising:

- 5 a) means for applying a layer of sacrificial material to said wafer surface,
- b) a laser for exposing said wafer to a photon flux effective for removing said sacrificial material and said particles, and
- c) means for providing a flow of vapor or gas across said wafer surface.

10 25. An improved semiconductor wafer processing apparatus as in claim 24, wherein said means for applying a layer of sacrificial material to said wafer surface is separated from said laser and from said means for providing a flow of vapor or gas.

25 26. An improved semiconductor wafer processing apparatus as in claim 24, further comprising:

- d) means for transferring a plurality of semiconductor wafers among a plurality of processing stations under program control and for creating and maintaining a data record for each wafer indicating processing results at each processing station, and

- e) means for transferring of cleaned wafers to an output station.

20 27. A method for cleaning a wafer surface and the like comprising the steps of:

- a) locating contaminant particles on said wafer surface and recording the coordinates of each particle in a record,

- b) providing laser means adapted for selectively exposing said wafer surface to laser light at said coordinates of each particle according to said record,

- c) exposing said wafer to light from said laser to selectively remove particles whose coordinates were recorded in said record.

25 28. A method for cleaning a wafer surface and the like as in claim 27, further comprising the step of:

- d) applying a film of sacrificial material to said wafer surface before performing said locating step (a).

28 29. A method for cleaning a wafer surface and the like and removing contaminant particles therefrom, comprising the steps of:

- a) applying a film of sacrificial material to the wafer,
- b) locating said contaminant particles on said wafer surface and recording the coordinates of each particle in a record,
- c) providing laser means adapted for selectively exposing said wafer surface to laser light at said coordinates of each particle, and
- d) selectively exposing said film and said wafer surface to light from said laser to selectively remove particles whose coordinates were recorded in said record.

10 29 30. A method as in claim 29, further comprising the step of:

- e) providing a flow of an inert gas across said wafer while performing said selectively exposing step (d).

30 31. A method as in claim 29, further comprising the step of:

- f) comparing said coordinates recorded in locating step (b) with device design data for identifying particles causing defects critical to device operation.

31 32. A method as in claim 31 wherein said laser light is selectively applied only at said coordinates of said defects critical to device operation and expected to affect device yield.

32 33. A method as in claim 29, further comprising the step of:

- g) comparing said coordinates mapped in locating step (b) with device design data for identifying defects critical to device operation, wherein said laser light is selectively applied only at said coordinates of said defects critical to device operation while ignoring other defects.

33 34. An improved semiconductor wafer processing apparatus for cleaning a wafer surface and the like and removing contaminant particles therefrom, said apparatus comprising:

- a) a first station including means for applying a layer of sacrificial material to said wafer surface,

b) a second station including means for locating said contaminant particles on said wafer surface and recording the coordinates of each particle in a record and means for transmitting said record, and

c) a third station including

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i) means for receiving said record from said second station,

ii) laser means adapted for selectively exposing said wafer surface to laser light at said coordinates of each particle according to said record, and

iii) means for providing a flow of vapor or gas across said wafer surface.

34 35. An improved semiconductor wafer processing apparatus as in claim 34, further comprising:

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d) means for transferring a plurality of semiconductor wafers among a plurality of processing stations under program control and for creating and maintaining a data record for each wafer indicating processing results at each processing station, and

35 e) means for transferring of cleaned wafers to an output station.

36. Apparatus as recited in claim 35, further comprising:

f) means for performing a final mapping and data record update of wafer surface defects in position coordinates before transfer of the cleaned wafers to said output station.

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